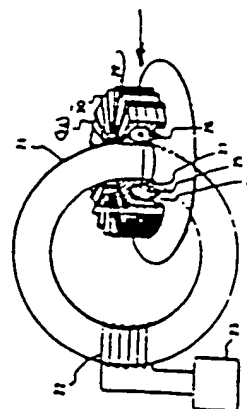


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(54) GENERATING METHOD OF HIGH PRESSURE PLASMA ARC
 (11) 2-250399 (A) (43) 23.10.1990 (19) JP
 (21) Appl. No. 64-78383 (22) 31.3.1989
 (71) FUJII DENPA KOKI K.K. (72) RYUICHI SHIMADA
 (51) Int. Cl. H05H1/46

PURPOSE: To generate high pressure plasma arc electrodelessly by generating plasma by means of applying high frequency voltage in a condition the gas pressure in furnace is sufficiently lowered, and then by retaining the plasma current and gradually increasing the pressure in furnace at the same time.

CONSTITUTION: In a condition the gas pressure in a hollow part 25 is sufficiently lowered so as to electrodeless discharge is easily performed, an induction field is generated from a high frequency oscillator 23 through a transformer core 21, according to the principle of transformer, and high frequency voltage is applied to a discharge tube 24 so as to generate a toroidal plasma. Then, as applying high frequency voltage, by retaining the plasma current and gradually increasing the gas pressure in the hollow part 25 at the same time, high pressure plasma arc is generated. Air current is rotated so as to offset plasma buoyancy generated at high pressure, and the plasma is thus generated near the center of the hollow part 25 stably for a long time.



22: primary coil, 24: glass insulator, 25: inlet hole, 26: exhaust hole, 27: polepiece, magnetic field coil, 28: toroidal magnetic field coil

① 日本国特許庁(JP)

② 特許出願公開

③ 公開特許公報(A) 平2-260399

④ Int.Cl.⁷

H 05 H 1/46

⑤ 発明の名称

⑥ 特許庁登録番号

7458-2G

⑦ 公開 平成2年(1990)10月23日

審査請求 未請求 請求項の数 2 (全4頁)

⑧ 発明の名称 高気圧プラズマアーク発生方法

⑨ 特許 平1-78383

⑩ 出願 平1(1989)3月31日

⑪ 発明者 堀田 隆一 神奈川県横浜市中区大丸10-3-404

⑫ 出願人 富士電機工業株式会社 埼玉県入間郡鶴ヶ島町富士見6-2-22

⑬ 代理人 弁護士 鈴江 武彦 外3名

明 細 書

1. 発明の名称

高気圧プラズマアーク発生方法

2. 発明の要旨

(1) 高気圧プラズマの発生び光を利用して、気体、液体の両相物質を分離する高気圧プラズマアークにおいて、管内のガス圧力を十分に上げた状態で高気圧電圧を印加しプラズマを発生させた後、そのプラズマ電流を遮断したまま管内電圧を徐々に上昇させることによって、高気圧のプラズマアークを発生することを特徴とする高気圧プラズマアーク発生方法。

(2) 高気圧プラズマアークとして、高気圧アークをトランス形式にて高気圧電圧を印加することにより、電極からの放電尖と電極の消耗をなくした高気圧プラズマアークを用いることを特徴とする請求項1記載の高気圧プラズマアーク発生方法。

3. 発明の具体的な説明

(産業上の利用分野)

本発明は高気圧プラズマの発生び光を利用して、

気体、液体の両相物質の分離を行う高気圧プラズマアークを用いた高気圧プラズマアーク発生方法の改良に関する。

(従来の技術)

高気圧プラズマの応用は、その光、熱を利用して照明、加熱アーク炉、アーク溶接等があり、その用途を拡大し、高気圧をうまく利用することが重要である。

高気圧プラズマはどのような両相物質も溶解的に完全のレベルに溶解する、という能力があり、高気圧プラズマの応用の一つとして高気圧両相分離が考えられる。例えばPCの分離とかフロン等の分離等がそれである。

一万多くの研究機関が研究されているが電力多消費プロセスとなるのが最大の問題点とされてきた。しかし、特に高気圧両相分離(5000度以上)では、ほかでは見られない高気圧を発生するという特徴がある。その性質を最大限利用して、両相物質の両相を分離することができ、プラズマの温度を発生のアークより高くして、2万度以上にし、

うに、電極で放電しやすいように中空部25内のガス圧力を十分下げた状態で、高周波電圧23からトランスコア21を介して電圧印の原理で放電電圧を発生させ、放電管24に高周波電圧を印加しトリガムプラズマを発生させる。その後、高周波電圧を印加しながら、そのプラズマ電圧を維持したまま中空部25内のガス圧力(気圧)を徐々に上昇させることによって、高気圧のプラズマアークを発生する。このとき、電圧を制御させ、高気圧になると急激なプラズマの膨れを防ぎ、プラズマを中空部25の中心近くに長時間安定に発生させる。従って、高気圧のプラズマアークをトランスコアにて高周波放電させることができ、電極からの放電欠と電極の損傷をなくすることが出来る。

尚、アークを高気圧にするには電圧密度を高める必要がある。そのためには電極間を狭く、気圧を高める必要がある。また電子密度とイオン密度の差を小さくして電極の放電を高めるにも気圧を高くするのがよい。

又、従来の高気圧のプラズマアークを得るためには電極をプレークアウンさせるに十分な高電圧を電極間に必要とするが、高周波でトランスコアのプラズマを高気圧ガス中で得る方法にはなかった。そこで、本発明によるプラズマアークは管内の気圧が制御できるトランスコア管と、電圧印の原理で高周波電圧を発生させるトランスコア及び高周波電圧印からなる。

【発明の効果】

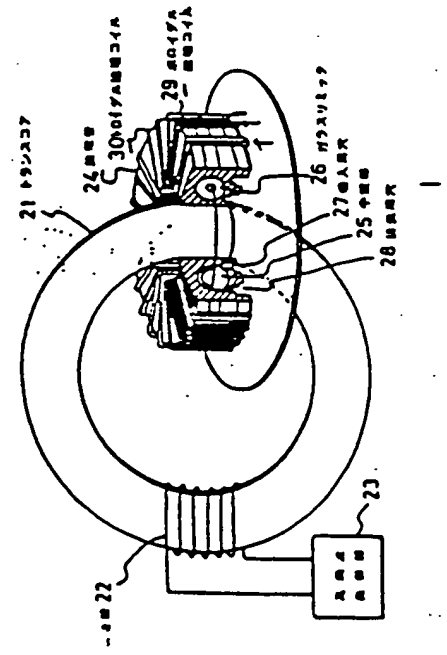
以上述べたように本発明によれば、高気圧プラズマアーク管において高気圧プラズマを高気圧にて、電極などの部品をなしに高周波電圧可能な高周波プラズマ管が得られ、効果のよい高気圧が得られる。

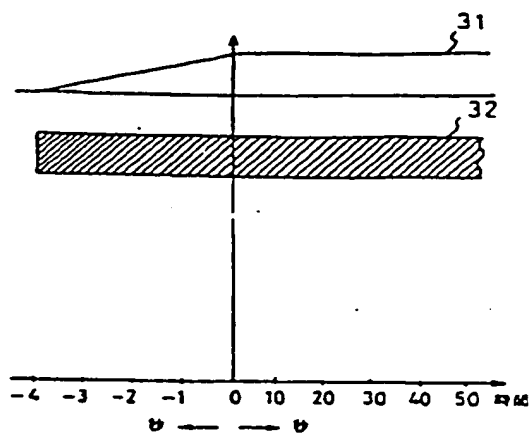
4. 図面の簡単な説明

図1図は本発明の一実施例を示す構成図、図2図は本発明に係るガス圧力印及び高周波電圧印の出力印図の一例を示す構成図、図3図は図2の角形内DCプラズマトークの電極構成を示す断面図、図4図は高気圧プラズマ発生原理を示す図

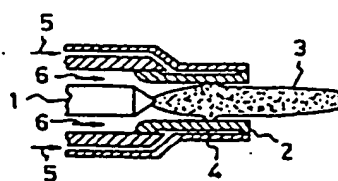
成断面図である。

- 21—トランスコア、22—1次巻線、
- 23—高周波電圧印、24—放電管、25—中空部、
- 26—ガラスリミッタ、27—吸入口穴、
- 28—排気口穴。

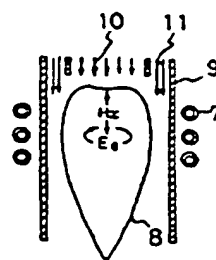




第 2 図



第 3 図



第 4 図

(19) Japan Patent Office (JP)

(12) Public Official Report of Patent (A)

(11) Public Number of Patent Application

2-260399

(43) Date of opening to public

1990/10/23

(51) Int. Cl.⁵ H05H 1/46 Identification symbol

Reference number in Patent Office 7458-2G

Part of Technical indication

Request of Examination Unrequest Number of requests 2 (all 4 pages)

(54) Name of the invention

Method of generating high-pressure plasma arc

(21) Application Number: 1-78383

(22) Date of Application: 1989/3/31

(72) Inventor: RYUICHI SHIMADA

10-3-404 Daimaru, Midori-ku, Yokohama-shi, Kanagawa Pref.

(71) Applicant: FUJI DENPA KOKI K.K.

6-2-22 Fujimi, Tsurugashima-shi, Saitama Pref.

(74) Agent: Lawyer TAKEHIKO SUZUE and three more

PURPOSE: To generate high pressure plasma arc electrodelessly by generating plasma by means of applying high frequency voltage in a condition the gas pressure in furnace is sufficiently lowered, and then by retaining the plasma current and gradually increasing the pressure in furnace at the same time.

CONSTITUTION: In a condition the gas pressure in a hollow part 25 is sufficiently lowered so as to electrodeless discharge is easily performed, an induction field is generated from a high frequency oscillator 23 through a transformer core 21, according to the principle of transformer, and high frequency voltage is applied to a discharge tube 24 so as to generate a toroidal plasma. Then, as applying high-frequency voltage, by retaining the plasma current and gradually increasing the gas pressure in the hollow part

25 at the same time, high pressure plasma arc is generated. Air current is rotated so as to offset plasma buoyancy generated at high pressure, and the plasma is thus generated near the center of the hollow part 25 stably for a long time.

Detailed statement

1. Name of invention

Method of generating high-pressure plasma arc

2. Limits of patent requests

(1) M

(2) The method of generating high pressure plasma arc in a high temperature plasma arc furnace to decompose organic and inorganic harmful materials using heating and light emission from the high pressure plasma by the followed procedure: First, the plasma is generated by applying high-frequency voltage in low gas pressure. After that, the high pressure plasma arc is generated by gradually increasing the gas pressure with sustaining the plasma power.

(2) The method of generating the high pressure plasma arc shown above (request (1)) in a high temperature plasma arc furnace, where electrodeless plasma is generated with the "torrus" shape of high pressure arc so that heat loss from the electrodes or the consumption of the electrodes is eliminated.

3. Detailed explanation of invention

Field of use in industry: This invention is related to the improvement of the method of high pressure plasma arc generation in a high temperature plasma arc furnace, where organic and inorganic harmful materials are decomposed by utilizing the heat and the light emission from the high pressure plasma.

Conventional technique: There are applications of heat plasmas such as light source, arc furnace for steel manufacture, arc welding, etc. utilizing the light and the heat from the plasma, where it is important to well utilize the plasma controllability and high temperature.

Plasma has an ability to finally destroy any poisonous wastes to elements level. Therefore, the decomposition of industrial wastes is considered one of the applications

of plasma furnaces. For example, the decomposition of PCB and Fluorocarbon, etc. Although many research results have been reported, the largest problem has been that this process consumed a lot of electric power. However, the plasma has a feature to generate high temperature, which is difficult to be obtained with the other methods, especially in high temperature ($> 5000\text{ }^{\circ}\text{C}$) and high density region. Utilizing this feature, it is possible to make a special ultra-high temperature furnace.

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Page 609.

After that, high pressure plasma arc is generated by gradually increasing the gas pressure in the hollow part 25 with sustaining the plasma current by applying high-frequency voltage. At this moment, the plasma buoyancy, which is generated at high pressure, is canceled by rotating the gas flow, and the plasma is generated at the center of the hollow part 25 stably for a long time. Therefore, it is possible to generate a high pressure plasma in a "torus" shape without electrodes and eliminate the heat loss from the electrodes and consumption of the electrodes.

It is necessary to increase the current density in order to make the high temperature arc. Therefore, it is necessary to decrease the radius of current path and increase the pressure. High pressure is also useful to increase the gas temperature by reducing the difference between the electron temperature and the ion temperature.

Conventionally, it was impossible to generate an electrodeless, "torus" shaped plasma in high pressure gas, because high voltage is required between the two electrodes enough to break down the high pressure gas and obtain high pressure plasma arc. Therefore, the plasma arc furnace related to this invention consists of a "torus" shaped chamber having pressure controllability, a transformer core to generate inductive field according to the principle of a transformer and a high-frequency oscillator.

Effectiveness of the invention

As mentioned above, this invention gives an electrodeless plasma which can be operated continuously without consumption parts such as electrodes in a high

temperature plasma arc furnace, and an efficient high temperature furnace can be provided.

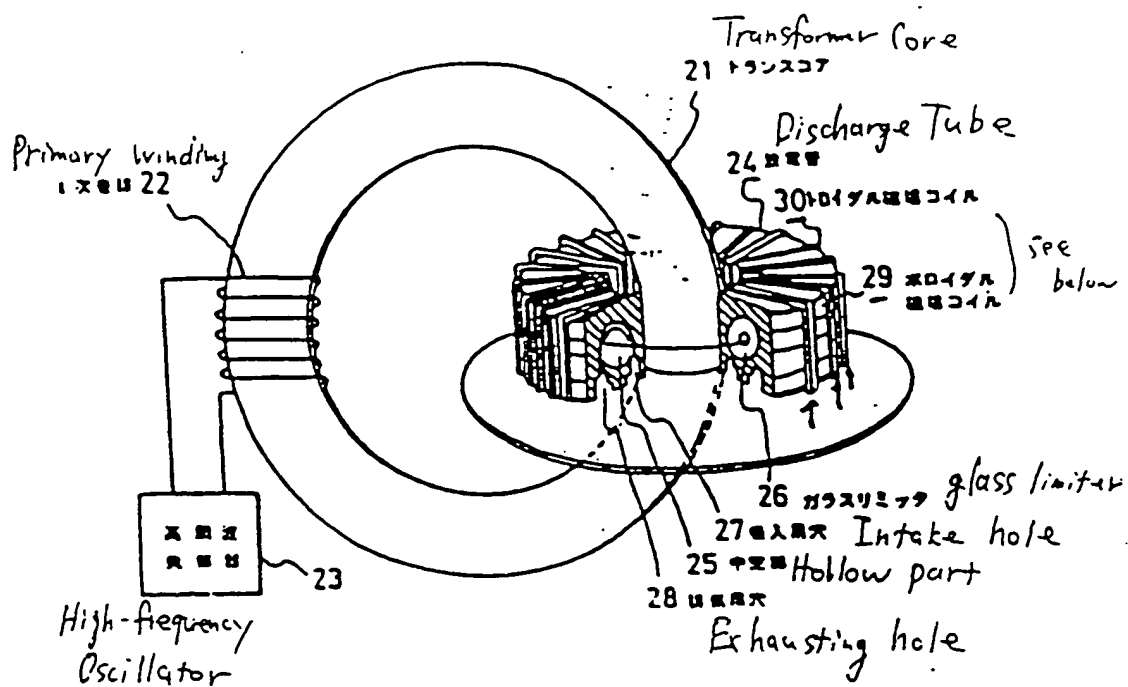
Simple explanations of the drawings

Figure 1 shows the structural view of an example of implementation using this invention. Figure 2 shows the characteristics of the gas pressure and the output of the high-frequency oscillator related to this invention. Figure 3 shows the cross section of the electrode structure of a typical DC plasma torch conventionally used. Figure 4 shows the structural cross section of the principle of high-frequency plasma generation. 21: transformer core, 22: primary winding, 23: high-frequency oscillator, 24: discharge tube, 25: hollow part, 26: glass limiter, 27: intake hole, 28 exhausting hole.

成を高める
り、気圧を
オシロ成の
も気圧を高

次図、
25...中空
管入用ス。

凡 示 図



第 1 図
Figure 1

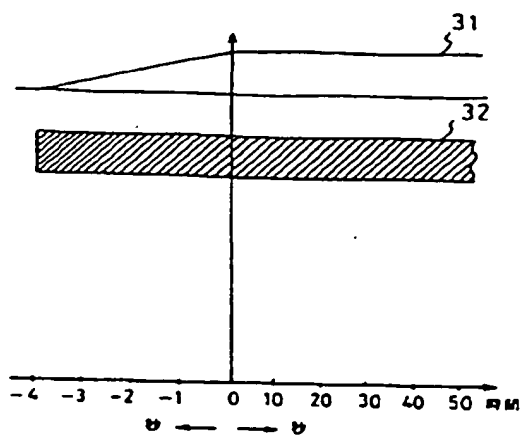
図 1 図は本発明の一実施例を示す構成図。図 2 図は本発明に係るガス圧力特性及び真空度特性図。図 3 図は従来の真空管の出力特性の一例を示す特性図。図 4 図は本発明の真空管の出力特性の一例を示す特性図。図 5 図は本発明の真空管の出力特性の一例を示す特性図。

30 Torroidal Magnetic Field Coil

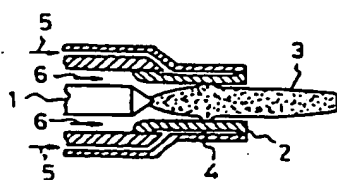
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29 Borroidal Magnetic Field Coil

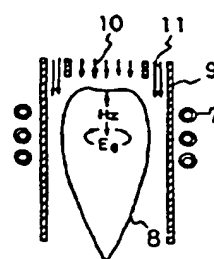
or
Perroidal



第 2 図



第 3 図



第 4 図